SUPPLEMENT 12-A

UTILITY CURVE METHODOLOGY

The utility curve is a common methodology used in DoD and industry to perform trade-off analysis. In DoD it is widely used for cost effectiveness analysis and proposal evaluation.

Utility Curve

The method uses a utility curve, Figure 12-2, for each of the decision factors to normalize them to ease comparison. This method establishes the relative value of the factor as it increases from the minimum value of the range. The curve shows can show a constant value relationship (straight line), increasing value (concave curve), decreasing value (convex curve), or a stepped value.

Decision Matrix

Each of the decision factors will also have relative value between them. These relative values are used to establish weighting factors for each decision factor. The weighting factors prioritize the decision factors and allow direct comparison between them. A decision matrix, similar to Figure 12-3, is generated to evaluate the relative value of the alternative solutions. In the case of Figure 12-3 range is given a weight of 2.0, speed a weight of 1.0, and payload a weight of 2.5. The utility values for each of the decision factors are multiplied by the appropriate weight. The weighted values for each alternative solution are added to obtain a total score for each solution. The solution with the highest score becomes the preferred solution. For the transport analysis of Figure 12-3 the apparent preferred solution is System 3.

Sensitivity

Figure 12-3 also illustrates a problem with the utility curve method. Both the utility curve and

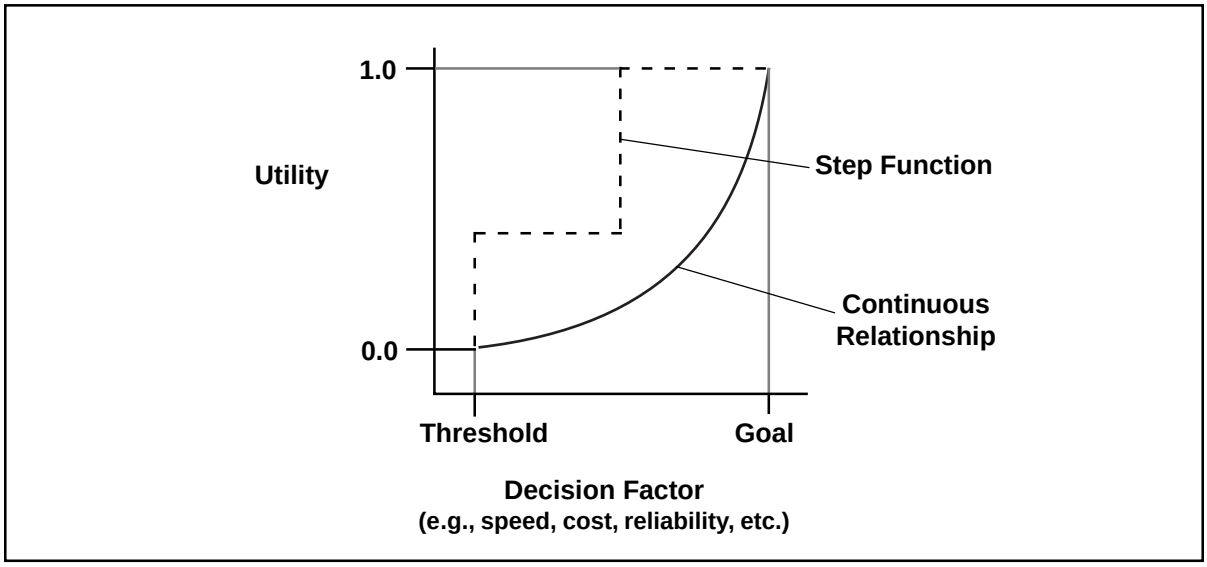

Figure 12-2. Utility Curve

weighting factors contain a degree of judgment that can vary between evaluators. Figure 12-3 shows three systems clustered around 3.8, indicating that a small variation in the utility curve or weighting factor could change the results. In the case of Figure 12-3, a sensitivity analysis should be performed to determine how solutions change as utility and weighting change. This will guide the evaluator in determining how to adjust evaluation criteria to eliminate the problem's sensitivity to small changes. In the case of Figure 12-3 the solution could be as simple as re-evaluating weighting factors to express better the true value to the customer. For example, if the value of range is considered to be less and payload worth more than originally stated, then System 4 may become a clear winner.

Notes

When developing or adjusting utility curves and weighting factors, communication with the customers and decision makers is essential. Most sensitivity problems are not as obvious as Figure 12-3. Sensitivity need not be apparent in the alternatives' total score. To ensure study viability, sensitivity analysis should always be done to examine the consequences of methodology choice. (Most decision support software provides a sensitivity analysis feature.)

Decision Factors / Alternatives	Range Wt. = 2.0		Speed Wt. = 1.0		Payload Wt. = 2.5		Weighted Total
	U	W	U	W	U	W	
Transport System 1	.8	1.6	.7	.7	.6	1.5	3.8
Transport System 2	.7	1.4	.9	.9	.4	1.0	3.3
Transport System 3	.6	1.2	.7	.7	.8	2.0	3.9
Transport System 4	.5	1.0	.5	.5	.9	2.25	3.75

Key: U = Utility value
W = Weighted value

Figure 12-3. Sample Decision Matrix